

SINGLE CRYSTAL SEED ALLOY

5 This invention concerns the composition of a metal alloy suitable for use as single crystal seeds.

Components cast as single crystals, using the process of directional solidification, generate a crystal atomic structure related to the growth of preferred crystal planes. In nickel base superalloys the resultant crystal has a structure determined by growth of the $\langle 001 \rangle$ crystal planes. This structure is aligned in the direction of solidification which is normally along the principal geometric axis of the component e.g. a gas turbine engine blade aerofoil.

20 In certain cases there are applications for components with crystal orientations different from the $\langle 001 \rangle$ produced under normal solidification conditions. Such applications include nozzle guide vanes and turbine blades requiring control of material rigidity.

25 To produce a crystal structure aligned in a
direction other than the preferred solidification
growth direction it is established practice to solidify
from a seed crystal which has the required crystal
structure. Solidification from these seeds is by
30 epitaxial growth in which the molten superalloy
solidifies directly from a partially melted seed
crystal made from the same or equivalent superalloy as
the cast component.

35 A drawback encountered with this known method of
determining crystal growth direction during

solidification is that a high level of castings are rejected because the seed crystals when partially molten are liable to generate unwanted oxide films which interrupt epitaxial growth of the single crystal and cause further crystals to solidify in which the atomic orientations are randomly distributed.

Epitaxial growth may also be interrupted if the alloy has a wide solidification temperature range (for example, greater than 50°C). This is because an alloy having a wide solidification temperature range tends to form a large mushy zone during solidification (i.e. a zone in which liquid and solid phases coexist), in which random crystal growth can occur.

A principal objective of the present invention is to reduce the rejection rate of single crystal alloy castings.

A further objective of the present invention is to provide a formulation of an alloy suitable for use as a seed alloy for single crystal casting, which alloy does not produce oxide films under the directional solidification conditions used for the casting of superalloys.

A yet further objective of the present invention is to provide a formulation of an alloy suitable for use as a seed alloy for single crystal casting, which alloy has a relatively narrow solidification temperature range.

SUMMARY OF THE INVENTION

According to the present invention there is provided an alloy composition suitable for use as a single crystal seed, the alloy composition comprising

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Alloy compositions in accordance with the present invention which have been investigated and found to be useful included a two-component nickel/tungsten alloy

5 containing tungsten in the range 5-45 weight %. Particularly suitable alloy compositions, having properties suitable for use as seed crystals in the manufacture of single crystal gas turbine engine components, contained tungsten in the range 30 to 45
10 weight %. However, the casting of components using seed crystals made from this range of alloys by conventional directional solidification was problematic owing to their high thermal conductivity, which made it difficult to control the rate of cooling during
15 withdrawal from the single crystal casting furnace through its temperature transition zone.

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